

Chapter 45

Conserving the Hawaiian stony coral, *Montipora dilatata* (Studer, 1901): a U.S. "species of concern"

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ABSTRACT

In 2004, National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) officially listed the Hawaiian stony coral, *Montipora dilatata*, as a "species of concern". Species of Concern are those species about which there is some concern regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the United States Endangered Species Act (ESA). Reasons for this listing are its believed limited range (being found mainly in Kaneohe Bay, Oahu, Hawaii), the role of invasive algae in the Bay in smothering coral colonies and the fact that the majority of colonies in Kaneohe Bay were lost during a coral bleaching event in the late 1990s.

In 2000, an extensive survey of Kaneohe Bay revealed only three large colonies. Four fragments were collected at this time and held at the Waikiki Aquarium for future propagation work. In 2004, the Waikiki Aquarium received federal funds to create a coral "ark" for rare Hawaiian corals based on its success with *M. dilatata* and other corals.

In 2006, the Aquarium received further funding from NMFS to building a coral propagation system exclusively for *M. dilatata*; to date, over 30 fragments have been created and placed for grow-out in this system. Long-range plans are for the removal of invasive alien algae from select areas within Kaneohe Bay and the gradual reintroduction of this species into its native habitat in the Bay followed by monitoring of its growth and survivorship. DNA analysis is also currently underway to determine the taxonomic status of *M. dilatata*.

INTRODUCTION

In 2004, the National Oceanographic and Atmospheric Administration's (NOAA), National Marine Fisheries Service (NMFS) officially listed the Hawaiian stony coral, *Montipora dilatata* (Studer, 1901), as a "species of concern". Species of Concern are those species about which there is some concern regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA). Listing a species comes with the benefit of government funding availability to learn more about a species to better determine its status in the wild and the threats it faces.

DISTRIBUTION

Montipora dilatata is a rare coral that has been reported only from the Hawaiian archipelago in Kaneohe Bay on the island of Oahu, and in the Northwestern Hawaiian Islands (NWHI) at Midway Atoll and Maro Reef. The species has not been recorded in any transect surveys, but it has been found to be uncommon in extensive visual surveys (Maragos, pers. com.).

Extensive surveys of Kaneohe Bay in 2000 identified only three colonies, where previously it had been uncommon but abundant (Hunter, pers. com.). This species occurs mainly in calm water, in subtidal environments.

MORPHOLOGY

The morphology of this species can be quite variable. Colonies may be any combination of encrustations, plates, knobs, and branches. Veron (2000) describes the species as follows: "Colonies are encrusting to submassive and up to 0.3 m across, with irregular branch-like upgrowths up to 100 mm thick which become flattened near their ends. Coenosteum papillae are inconspicuous. Corallite walls are well defined." In the original description the species is described as a coral that builds horizontally expanding thin sheets that are often leaf-like (15 mm thick). Colonies are usually purple or brown and reach 1 m in diameter. *Montipora dilatata* can be easily broken into fragments by storms or natural bioerosional processes, with the fragments readily growing into new colonies.

At present, its taxonomic status is muddled and DNA work is required to determine its distinctiveness compared to the similar species *Montipora capitata* (Dana, 1846) and *Montipora turgescens* (Bernard, 1897). Another species *M. cf. dilatata* (recorded at one site out of 30 surveyed at Maro Reef in 2000-2002) is also similar, and genetic analysis should be done to confirm their separation into distinct species (Maragos, pers. com.). If the Kaneohe and Maro species are the same, then the argument could be made that they are still rare enough to be listed as threatened or endangered under the ESA since only a single site with several colonies was reported at Maro. But if the so-called *M. turgescens* is the same as the *M. dilatata* of Kaneohe Bay, then there may be little justification for listing except that it is rare in the main Hawaiian Islands (but prolific in the distal NWHI).

THREATS

The main threats to this coral species are:

- 1) vulnerability to coral bleaching (as observed in 2002 at Midway, Kure and Pearl and Hermes reefs, and in Kaneohe Bay in 1999);
- 2) habitat degradation and modification as a result of sedimentation, pollution, alien algae species (*Gracilaria salicornia* Dawson 1954, *Kappaphycus/Eucheuma* spp.) and invasive green alga (*Dictyosphaeria cavernosa* (Forsskål) Børgesen, 1932c) in Kaneohe Bay;
- 3) a limited distribution and;

- 4) damage by anchors, fish pots, swimmers, and divers (Hunter, Maragos, pers. com.).

BACKGROUND TO THE WAIKIKI AQUARIUM PROPAGATION PROJECT

Following a coral bleaching episode triggered by light winds and high solar irradiance in Kaneohe Bay in the summer of 1999, several large stands of *M. dilatata* died off and did not recover. During a survey of the Bay over a two-day period in May 2000, the Waikiki Aquarium curator at the time, Dr. Cindy Hunter, and David Gulko of the State Department of Land and Natural Resources (DLNR) found only three living colonies. Three samples were taken from one of the colonies, two of which were fragmented into two producing four pieces that were relocated to the Aquarium; the third was taken for taxonomic work. Two pieces were placed in a back area holding tank and two on exhibit; unfortunately the two on display died a few months later. These fragments were approximately 10 cm long and 1.25 cm wide at the time of collection.

PROPAGATION EFFORTS AT THE WAIKIKI AQUARIUM

By 2002, the two fragments in back holding had increased in size to several colonies over 20 cm in diameter so it was decided to remove two small colonies into an outdoor exhibit, the Edge of the Reef, a 26.6 m³ open system with Hawaiian corals and fish. Both of these colonies are now (March, 2007) over 30 cm in diameter and 15 cm tall.

In 2004, the Waikiki Aquarium received a small grant from the DLNR to construct a coral "ark" tank behind the scenes. The purpose of this 900 L open system was to house rare Hawaiian corals to serve as a genetic and specimen repository. The system consists of a simple square custom-made fiberglass tank, 1.2 x 1.2 x 0.6 m. Air bubblers situated in each corner connected to an air blower achieve water motion. The tank is run as an open system using seawater from a saltwater well, with an inflow rate of approximately 240 L.h⁻¹, this rate is varied over the course of the year to prevent the water temperature from climbing above 27 °C. Live rock was placed on the bottom of the tank, and the corals were then placed on

these. The first specimen placed in this system was a 10 cm diameter colony of *M. dilatata* in October of 2004; that colony is now (March, 2007) over 40 cm in diameter and 20 cm tall, and consists of three distinct colonies; a result of incidental fragmentation.

A CALL TO ACTION

In August of 2006, a meeting was held with NOAA, NMFS and other interested parties, to discuss the status of and make proposals for dealing with the species of concern they had identified so far; amongst these is *M. dilatata*. After extensive discussions and a presentation by the Waikiki Aquarium on the growth success of its specimens, an action plan was decided upon and needs were identified as follows:

- 1) a quantitative survey of Kaneohe Bay to systematically map species distribution and determine population size;
- 2) comprehensive surveys of the NWHI are required to determine location and population size;
- 3) genetic work with molecular markers to determine if: A) fragments collected in 2000 from Kaneohe Bay; B) current colonies in Kaneohe Bay; and C) colonies from multiple sites in the NWHI are all in fact *M. dilatata*, a hybrid species, or another species of *Montipora*;
- 4) determine if reintroducing the species to Kaneohe Bay is feasible and if so, begin test reintroductions; and
- 5) confirm species presence/absence in Ambon, Indonesia and Japan.

MONTIPORA DILATATA PROPAGATION SYSTEM

An additional outcome of the meeting was the awarding of funds from NMFS to the Waikiki Aquarium for the construction of a *M. dilatata* propagation system. Modeled after other coral propagation systems at the Aquarium (see Delbeek and Sprung, 2005), it consists of a 2.7 m long, 1.2 m wide and 0.75 m tall fiberglass tank with an attached overflow/ sump built into one end; the total volume of the system is 2.5 m³. The tank uses a ½ HP pump for water circulation, and airstones for additional turbulence and to break up the water surface. Live rocks were added to the bottom of the tank and plastic shelving mounted onto fiberglass threaded support rods were added

to allow for the placement of fragments off the bottom of the tank. Herbivores such as Hawaiian convict surgeonfish (x4), *Acanthurus triostegus* (Linnaeus, 1758), and collector urchins (x10), *Tripneustes gratilla* (Linnaeus, 1758), were added to control diatom and algal growth. The system is open and saltwater from a saltwater well that extended 24 m into the coral rock under the Aquarium property is used as the sole water source. This water has been described elsewhere (see Atkinson *et al.*, 1995; Delbeek and Sprung, 2005; Delbeek, 2006) but compared to natural seawater it is high in dissolved inorganic carbon, silicate, nitrogen, phosphorous, iron, manganese and a host of other inorganic compounds, but very low in dissolved organics. This makes for accelerated algal growth after initial setup but also excellent coral growth (Atkinson *et al.*, 1995). The system was completed in October of 2006 and 25 fragments of *M. dilatata* were added at that time from the coral "ark" tank specimen. At this time (March, 2007), the fragments have attached to base rock and are beginning to exhibit length extension; measurements of growth rate will soon be conducted.

FUTURE OBJECTIVES

At present, the Aquarium is awaiting meetings with DLNR and NMFS to determine the best course of action for the out-planting of *M. dilatata* fragments propagated at the Aquarium. Most likely this will consist first of the mass removal of invasive algae from selected test areas within Kaneohe Bay, and then the transplantation of a small number of fragments to the reef at various depths, followed by long-term monitoring of growth and survival, and then comparing this to growth in the Aquarium's propagation system. Depending on the success of the trial transplants, the program may be expanded to increase the fragmentation capacity of our system.

At present, funding is still being sought to conduct field surveys of *M. dilatata* in Kaneohe Bay, genetic work has begun on colonies of coral in Kaneohe Bay thought to be *M. dilatata*, however, since the Northwestern Hawaiian Islands have been given National Monument status by US President Bush in 2007, collecting permit applications have become extremely complicated and are still being explored.



Figure left: Colony of *Montipora dilatata*

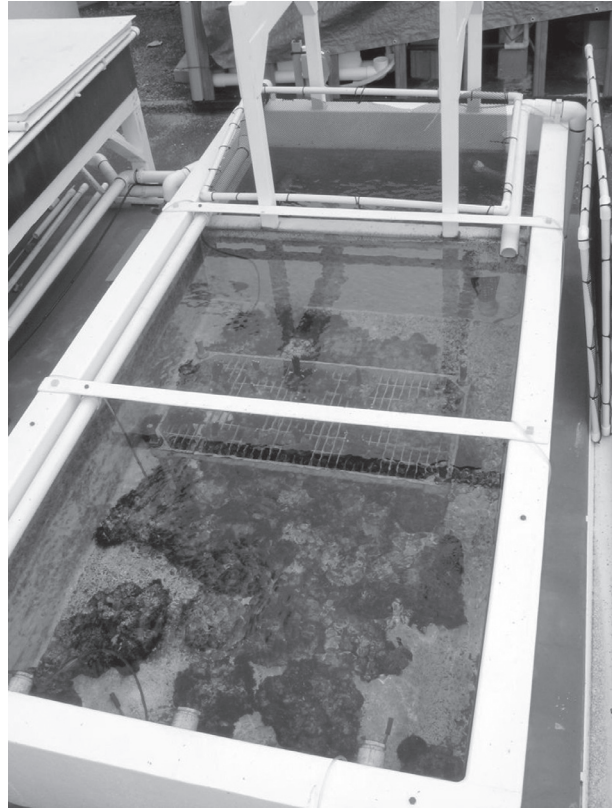


Figure right: The aquarium's propagation tank

Finally, preserved fragments of *M. dilatata* and *M. capitata* were provided to Dr. R. Toonen of the Hawaii Institute of Marine Biology, University of Hawaii, for DNA analysis to determine the taxonomic status of *M. dilatata* with respect to this other, closely related and common species. The Aquarium's specimens of each species were found to be genetically distinct from each other.

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PERSONAL COMMUNICATIONS

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